



(21) Lutetia - low mass, high density

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Abstract

The Rosetta spacecraft encountered its second asteroid target (21) Lutetia on 10th July 2010. The asteroid perturbed the flyby trajectory and velocity of the spacecraft (closest approach is at 3168 km). The mass of the asteroid was determined from the shift of the radio carrier signal frequency at X-band (8.4 GHz). Although the flyby geometry was suboptimal and there is a tracking gap at closest approach, the mass was determined to $1.7 \cdot 10^{18}$ kg at an uncertainty of 1%. Major driver of the uncertainty are the frequency noise level, the tropospheric correction and the uncertainty of the closest approach distance. The Rosetta camera OSIRIS determined the size and volume of Lutetia. The bulk density is derived from the determined mass and volume to (3400 ± 275) kg/m³. The precision of the bulk density is driven by the precision of the volume estimate. Knowledge of the mass and bulk density is an important contributor to understand the asteroid's composition, internal structure and porosity. Lutetia is considered to be a major perturber of a number of smaller asteroids and a perturber of the motion of Mars. The derived mass from the Rosetta flyby will therefore be compared with those mass values derived from astrometry.